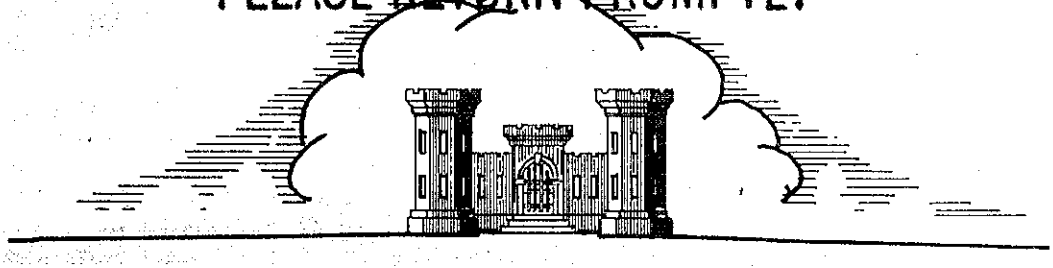
PAWTUXET RIVER FLOOD CONTROL PROJECT

PONTIAC DIVERSION

PAWTUXET RIVER, R. I.

DEFINITE PROJECT REPORT

(PRELIMINARY)



WAR DEPARTMENT CORPS OF ENGINEERS U. S. ARMY
U. S. ENGINEER OFFICE PROVIDENCE, R. I.

JUNE 1944

War Department
United States Engineer Office
Providence, Rhode Island

PAWTUXET RIVER FLOOD CONTROL PROJECT

PRELIMINARY

DEFINITE PROJECT REPORT

PONTIAC DIVERSION

PAWTUXET RIVER, RHODE ISLAND

June 1944

PRELIMINARY
DEFINITE PROJECT REPORT
PONTIAC DIVERSION
PAWTUXET RIVER, RHODE ISLAND

C O N T E N T S

INDEX TO PLATES

War Department
United States Engineer Office
Providence, Rhode Island

PRELIMINARY
DEFINITE PROJECT REPORT
PONTIAC DIVERSION
PAWTUXET RIVER, RHODE ISLAND

1. Authorization. - Flood Control Act approved 18 August 1941 (Public No. 228 - 77th Congress, 1st session).

2. Basic Report. - The project is one of two units in the authorized plan for the control of floods in the Pawtuxet River Basin, Rhode Island, (House Document No. 747, 76th Congress, 3rd session) and provides for the protection of highly developed industrial and residential areas in the cities of Cranston and Warwick, Rhode Island through diversion of flood water from the Pawtuxet River at a location above these areas by means of a diversion dam and diversion channel to Apponaug Cove of Narragansett Bay.

3. Location and Description of the Area Affected. - a. The cities of Cranston and Warwick, Rhode Island are a part of the highly developed industrial and residential area adjoining the City of Providence, Rhode Island. The Pawtuxet River forms the boundary between the two cities and areas within both municipalities are subject to partial inundation when the river is in flood. The combined populations of the two cities, from the census of 1940, is approximately 72,000. The section of the Pawtuxet River from which flood water will be diverted under this project extends from the mouth to the village of Pontiac, a distance of approximately 7 miles. The lower three miles of this section contain the major portion of the residential and industrial development which are the chief beneficiaries of the project. The upper four miles of the section contain agricultural property with a few isolated mills.

b. The area subject to flooding and for which protection will be provided extends more or less uniformly for a distance of 7 miles along the river through the area described above. Although

much of this flooded area is waste land, some is devoted to agriculture, and in the lower reaches the highly developed residential areas known locally as Belmont Park and South Elmwood are included.

c. There are no existing flood protection works for this area and, with the exception of those discussed in "Report on Survey for Flood Control on the Pawtuxet River, Rhode Island", (House Document No. 747, 76th Congress, 3rd session), none have been proposed. Although the Pontiac Diversion is one of two units in the comprehensive plan for the control of floods in the Pawtuxet River Basin, there is no relation between the Pontiac Diversion Project and the second unit of the comprehensive plan. The second unit is known as the Clyde Levee, and consists of a levee and pumping station located approximately three miles upstream from the Pontiac Diversion, on the North Branch of the Pawtuxet River.

4. Definite Project Plan. - a. The Pontiac Diversion will provide a means whereby the flood flows in excess of the downstream channel capacity of the Pawtuxet River will be diverted from the present river channel at Pontiac and carried by the shortest route through a proposed channel to an outfall in Apponaug Cove, an arm of Narragansett Bay. In this manner the property adjacent to the river over the seven mile reach from Pontiac to the mouth will be protected from flooding. The principal items of construction will consist of the diversion dam to be constructed at Pontiac, R. I., and the diversion channel to extend from the present river channel upstream of the dam to Apponaug Cove. Stream flow will be excluded from the diversion channel at all times except during floods.

b. The design, or project, flood is 35,000 cubic feet per second (180 c.f.s. per sq. mi. over 194.7 sq. miles) without modification by existing storage. However, the existence of the Scituate Reservoir on the North Branch of the river upstream of Pontiac permits modification of the project flood by utilizing the surcharge storage provided by the reservoir. The design flood so modified is 28,700 cubic feet per second. The design flood is approximately double the maximum flood of record at this location (14,150 c.f.s. in February 1886). The approximate stages of the Pawtuxet River at Pontiac for the above-mentioned floods are as follows:

Maximum flood of record, Feb. 1886	8.65 feet
Design flood, unmodified	12.36 feet
Design flood, modified	11.12 feet

5. Type of Structure and Engineering Features. - a. Dam. - (1) The diversion dam across the Pawtuxet River will be a rolled earth fill section with an upstream blanket of impervious material. Foundation investigations at the dam site indicate that rock lies approximately 70 feet below ground surface at the river and is overlain for the entire depth with loose sand and gravel. In order to prevent excessive seepage and possible failure through excessive piping, the structure is provided with a steel sheet pile cutoff approximately 40 feet long to effect a partial cutoff. A drain will be provided at the downstream toe of the dam to control seepage under the cutoff. The total length of the dam will be approximately 1800 feet and the maximum height will be approximately 28 feet above the river bed. The top of the dam will be at elevation 46.0 m.s.l. providing a freeboard of 5 feet, and will have a top width of 20 feet. The side slopes will be 1 on 3 with the upstream face paved with hand-placed riprap. The downstream face will be topsoiled and seeded. Random pervious fill material for the construction of the embankment will be available in ample quantity from the proposed channel improvement. Impervious material is available within one mile of the site.

(2) The reinforced concrete outlet gate structure for the dam will contain three 15-foot wide by 8.5-foot high Stoney type gates, operated by a traveling gantry crane. Steel sheet-pile cutoffs will be provided to prevent piping and the approach and discharge channels will be paved with riprap. The sill elevation of the gates will be 23.0 feet. The outlet structure is designed to pass a maximum discharge of 4,500 cubic feet per second at maximum water elevation. This maximum discharge corresponds to the channel capacity of the natural river channel below Pontiac with allowance for natural inflow below the dam.

(3) Consideration is being given to the provision of a outlet structure in the dam with automatically operated gates, and upon the completion of surveys and hydrological studies this feature may be incorporated in the final Definite Project Report.

b. Diversion Channel. - (1) The design capacity of the diversion channel will be 25,000 cubic feet per second which represents the design flood less the capacity of the existing river channel below the dam. The capacity of the river channel below the dam has been deducted from the design flood since the fixed outlet structure at the dam will function as indicated in Paragraph (3) above, and insure that the design capacity of the outlet structure in the dam is available at all times.

(2) The diversion channel may be divided into three sections: (1) that section extending from the inlet structure to that portion of Gorton's Pond lying west of Highway 5; (2) the section through Gorton's Pond to the weir at Apponaug Mill; (3) the canal from Apponaug Mill to Apponaug Cove. These sections will be described separately.

(3) Section 1. - The initial section of the diversion channel consists of a controlled spillway weir structure and approximately 4300 feet of concrete-lined excavated channel. The entrance structure consists of 8 Stoney type gates, each 8'-6" high by 15'-0" wide, set in reinforced concrete and operated by a traveling gantry crane. The sill elevation of the gates is 21.4. Flow elevation at design flood is 39.6. Entrance to the gates is made over a riprap apron between concrete training walls.

The concrete lined diversion channel begins immediately following the entrance structure. A lined channel is used in order to avoid the excessive excavation which would be required for the equivalent unlined channel. Flow velocities approximate 20 feet per second. The bottom of the channel parallels the hydraulic gradient with a slope of .18 percent. At approximately Sta. 84+00, the concrete lined channel discharges into Gorton's Pond over a riprap apron.

(4) Section 2. - Gorton's Pond is a small storage reservoir supplied by a stream of local origin. Through a rather complex system of earth channels and a penstock it supplies water for processing and power to the Apponaug Mill. The diversion passes through the pond and over a weir which will replace the existing retention facilities. Necessary existing facilities for providing water for the mill will be relocated

only as may be necessary to permit operation independent of the diversion.

Owing to the fact that residential property and a highway, Route 5, located along the banks of Gorton Pond would be inundated under conditions of maximum discharge in the diversion, construction of earth dikes will be required. The maximum height of the dikes required will be 15 feet providing a freeboard of 5 feet. The total length of dike required will be approximately 1500 feet. The dikes will have a crown width of 10 feet and side slopes will be 1 on 2. The dikes will be constructed of random material with a blanket of impervious material facing the diversion. With the exception of those portions of the dike adjacent to the weir, riprap protection will generally not be required since velocities in this reach are relatively low.

The elevation of the weir crest at the foot of Gorton's Pond will be 15.0 feet m.s.l. The weir will be a concrete ogee section 200 feet long with the crest 13 feet above the bottom of the channel into which it discharges. Concrete abutments will key it into the levees at both ends, and steel sheet piling cutoffs will be provided at heel and toe. The foundation will consist of the existing sand and gravel subgrade.

(5) Section 3. - A concrete lined channel will extend from the weir to the tidal estuary known as the Apponaug Cove. The channel will be similar in construction to that forming the first section of the diversion, but a steeper slope permits the section to be reduced. At the point of discharge into Apponaug Cove, the bottom of the channel will be at-9.0 feet elevation. Concrete wingwalls and a dumped rock apron will be provided here to prevent undermining.

(6) Bridges. - Three bridges will be needed to carry existing roads over the diversion channel at East Avenue and at State Highways Nos. 117 and 1. The East Avenue Bridge would be a steel arch type 30 feet wide, with a 150-foot central span and short overhanging entrance spans. Concrete covered steel girder bridges 50 feet wide and with a single span of

90 feet will be used to carry Highways Nos. 117 and 1 over the channel. On Highway No. 1 the proposed bridge will replace an existing bridge of smaller capacity. Traffic on Highways Nos. 117 and 1 would have to be maintained during construction of the bridges, while traffic on East Avenue can be detoured.

(7) Foundation Explorations. - The foundation throughout the length of the diversion channel has been investigated by a total of 18 drive sample borings located as shown on the drawings. These investigations indicate that bedrock in general lies at a depth below any proposed channel excavation; however the rock surface is irregular and small quantities of rock excavation will be required. The foundation exploration borings indicate further that the overburden to be removed will consist mostly of sands and silts with some gravels.

(8) Consideration is being given to the provision of fully automatic entrance facilities to the diversion channel and upon completion of surveys and hydrological studies this feature may be incorporated in the final Definite Project Report.

For Cost Estimate see following page.

6. Cost Estimate.

Item	Quantity	Unit	Unit Price	Amount	Total
1. Construction Cost					
a. Diversion Channel					
Clearing	43	Acre	$150.00	$ 6,450	
Stripping	2,600	c.y.	0.50	1,300	
Stream control		job		15,000	
Excavation, channel	690,300	c.y.	0.25	172,575	
Excavation, cutoff	1,640	c.y.	0.50	820	
Excavation, structural	9,250	c.y.	1.00	9,250	
Excavation, rock	8,350	c.y.	3.00	25,050	
Borrow, impervious	6,200	c.y.	0.40	2,480	
Embankment, placing	22,400	c.y.	0.30	6,720	
Topsoil	1,200	c.y.	0.50	600	
Gravel bedding	9,150	c.y.	2.50	22,875	
Riprap	6,250	c.y.	5.00	31,250	
Dumped rock	3,700	c.y.	2.50	9,250	
Sheet piling, steel	30,000	s.f.	1.10	33,000	
Concrete, Class "A"	4,650	c.y.	18.00	83,700	
Concrete, Class "B"	1,100	c.y.	14.00	15,400	
Concrete, channel lining	73,000	s.y.	2.30	167,900	
Reinforcing	1,475,000	lb.	0.05	73,750	
Tile drains	7,400	l.f.	0.70	5,180	
Gates, machinery		job		45,000	
				727,550	
Contingencies 20%				145,450	
				873,000	
Engineering & Overhead 15%				131,000	
Total					$1,004,000
b. Diversion Dam					
Clearing	8	Acre	$250.00	$ 2,000	
Stripping	5,100	c.y.	0.50	2,550	
Stream control		job		10,000	
Excavation cutoff	4,000	c.y.	0.50	2,000	
Borrow, impervious	18,000	c.y.	0.40	7,200	
Embankment, placing	45,300	c.y.	0.30	13,590	
Topsoil	2,200	c.y.	0.50	1,100	
Gravel bedding	1,000	c.y.	2.50	2,500	
Riprap	700	c.y.	5.00	3,500	
Dumped rock	5,300	c.y.	2.50	13,250	
Sheet piling, steel	35,000	s.f.	1.10	38,500	
Concrete, Class "A"	1,290	c.y.	18.00	23,220	
Reinforcing	155,000	lb.	0.05	7,750	
Tile drains	1,400	l.f.	0.70	980	
Gates, machinery		job		20,000	
				148,140	
Contingencies 20%				29,660	
				177,800	
Engineering & Overhead 15%				26,200	
Total					$ 204,000

Item	Quantity	Unit	Unit Price	Amount	Total
2. Highway Bridges					
Highway Route No. 1		job		$ 54,000	
Highway Route No. 17		job		54,000	
East Avenue		job		58,000	
				166,000	
Contingencies 20%				33,200	
				199,200	
Engineering & Overhead 20%				29,800	
Total					$ 229,000
3. Rights-of-way and Damages					
Land		L.S.		45,000	
Damages		L.S.		21,000	
				66,000	
Legal, overhead, and general expense, 20%				13,000	
					$ 79,000
4. Grand total estimated cost					$1,516,000
TOTAL COST TO LOCAL INTERESTS AS STIPULATED IN AUTHORIZATION					$ 347,500
ESTIMATED TOTAL COST TO THE UNITED STATES					$1,168,500

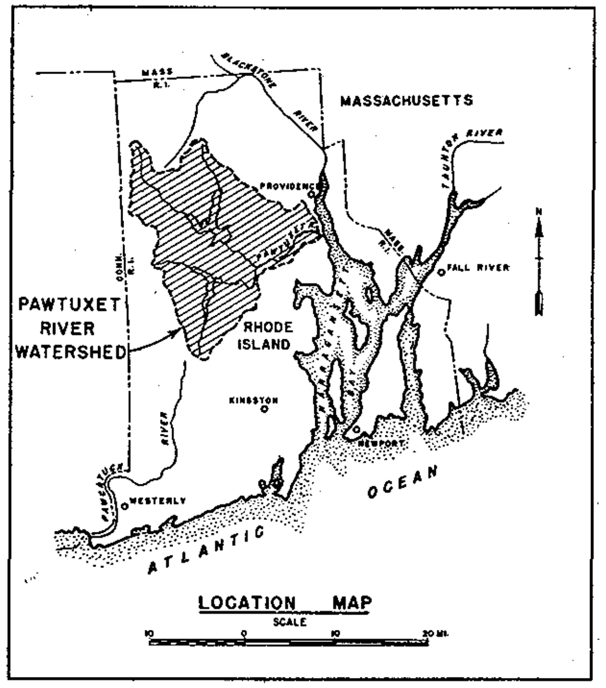
7. Results Expected. - The proposed works will afford protection against floods to property adjacent to the Pawtuxet River from Pontiac to the mouth, a distance of approximately 7 miles. The total value of real and personal property within this reach subject to inundation under the maximum probable flood is estimated at $4,728,000. The total of direct losses suffered in this area in the 1938 flood was estimated at $82,000.

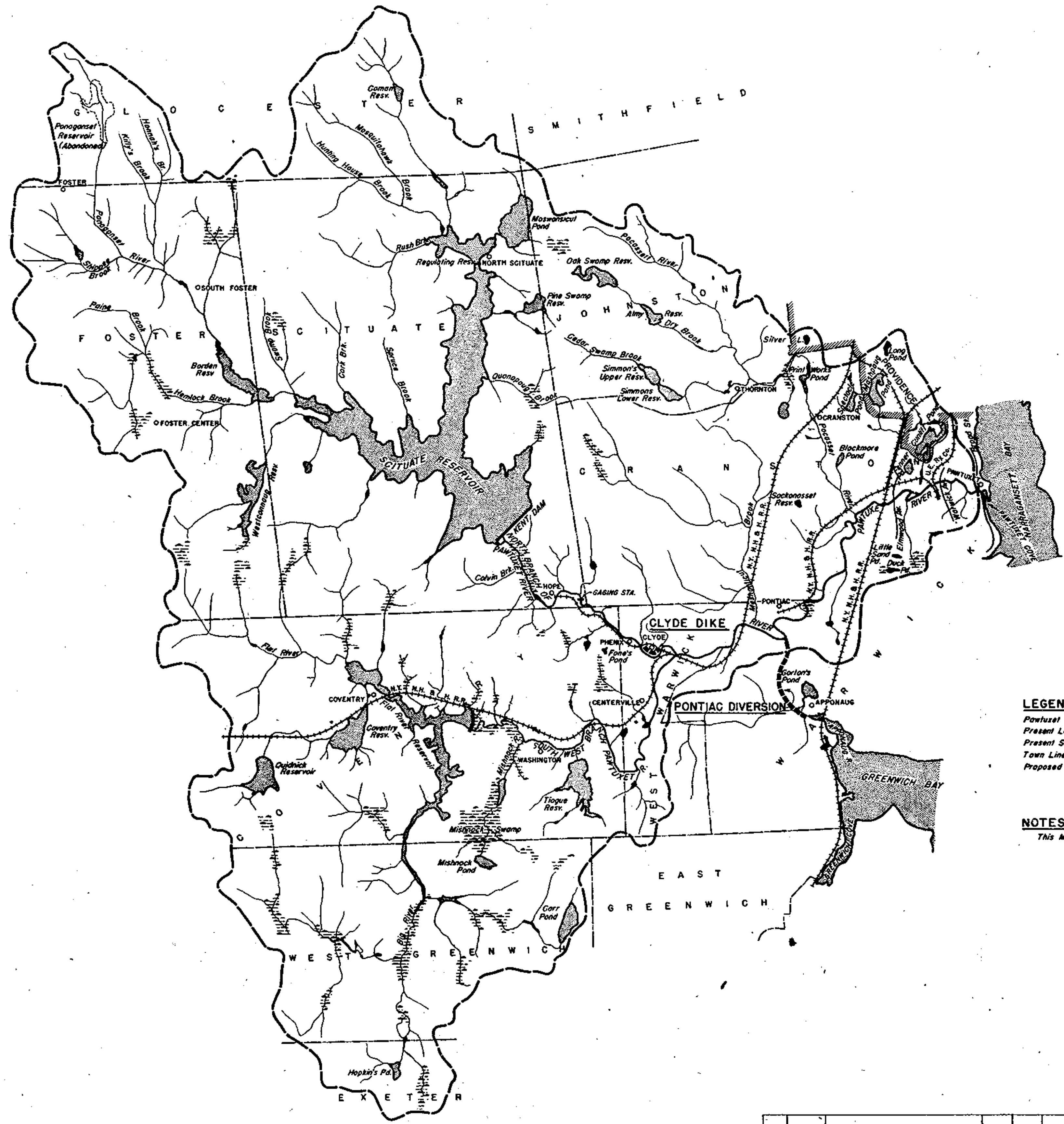
8. Local Cooperation. - The authorization of the Pontiac Diversion project (see Paragraph 1) stipulates that local interests shall furnish 25 percent of the total capital cost or an amount not exceeding $347,500. Accordingly, the State of Rhode Island has been approached by this office regarding the furnishing of assurances that the sum of $347,500 will be provided by local interests as their share of the total capital cost. The proposal is in the process of review by the current State administration and it is expected that favorable tentative assurances will be forthcoming at an early date.

9. Time Required for Construction. - It is estimated that a total construction period of 18 months will be required for completion of the proposed work.

W. J. Truss
Colonel, Corps of Engineers
District Engineer

Attached:
Drawings File Nos. PT-4-1010
PT-4-1014
PT-4-1015
Soils Classification





LEGEND

Pawtuxet Watershed Boundaries shown thus
Present Large Reservoirs, Lakes, and ponds
Present Small Reservoirs, Lakes, and ponds
Town Lines shown thus
Proposed Flood Control Works

NOTES

This Map reproduced from U. S. Geological Survey Quadrangle Sheets.

KEY	DATE	REVISION (Indicated by △)	REV. BY	CK. BY	APP. BY

PAWTUXET RIVER FLOOD CONTROL

PAWTUXET RIVER WATERSHED

LOCATION MAP OF PROJECTS

PAWTUXET RIVER — RHODE ISLAND

IN SHEETS — SCALE: 1: 62,500 — SHEET NO.

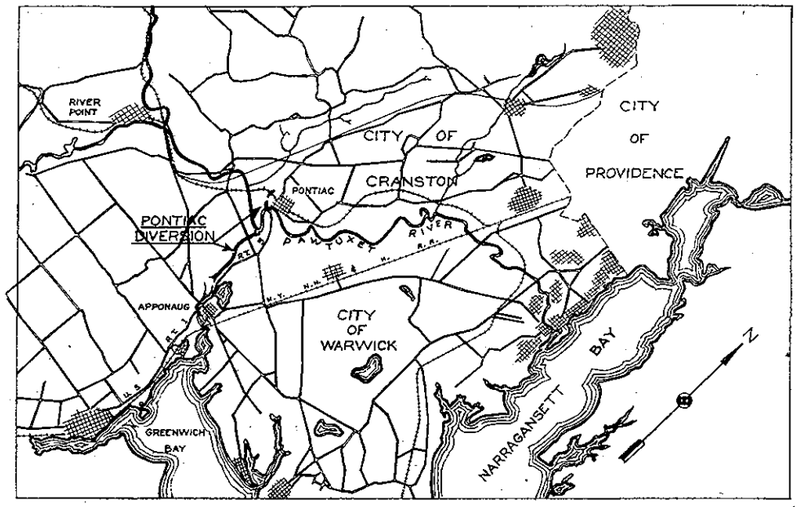
U. S. ENGINEER OFFICE, PROVIDENCE, R. I — JUNE 1944

SUBMITTED: PROJECT ENGINEER — APPROVAL RECOMMENDED: HEAD ENGINEER, CHIEF, ENGINEERING DIV. — APPROVED: COL. CORPS OF ENGINEERS, DISTRICT ENGINEER

PREPARED: PROJECT/UNIT NO. 4 — DRAWN: J.S. TRACED: W.L. CHECKED: W.R.K. — FILE NO. PT-4-1010

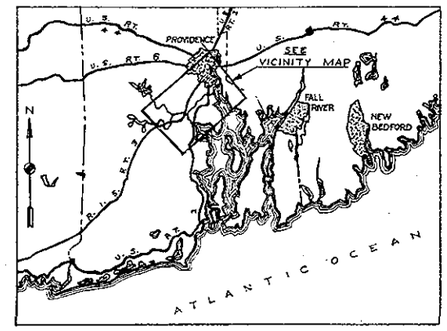
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



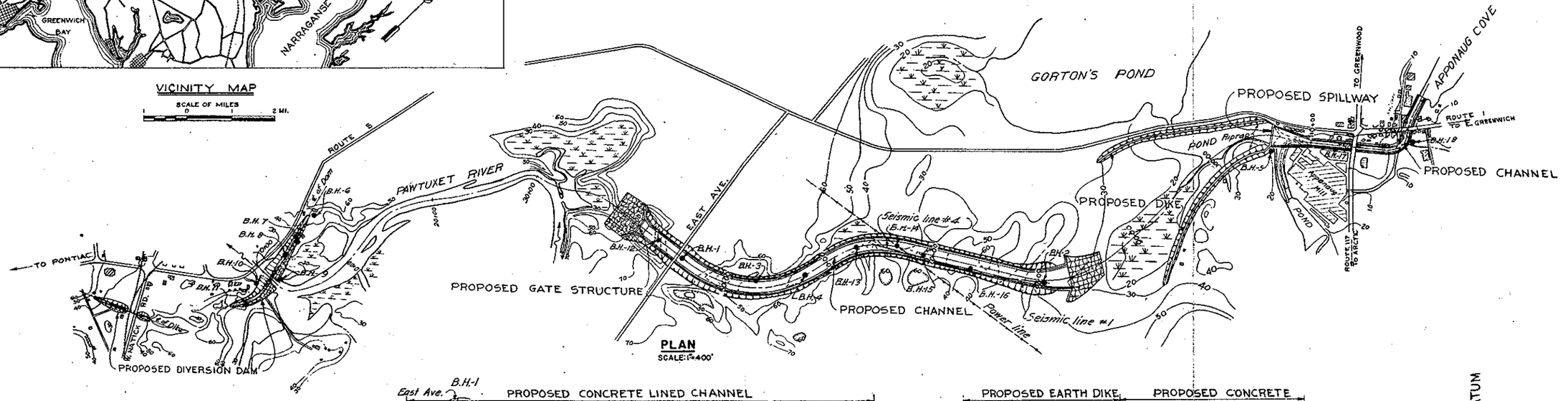
VICINITY MAP

SCALE OF MILES 0 1 2 MI.



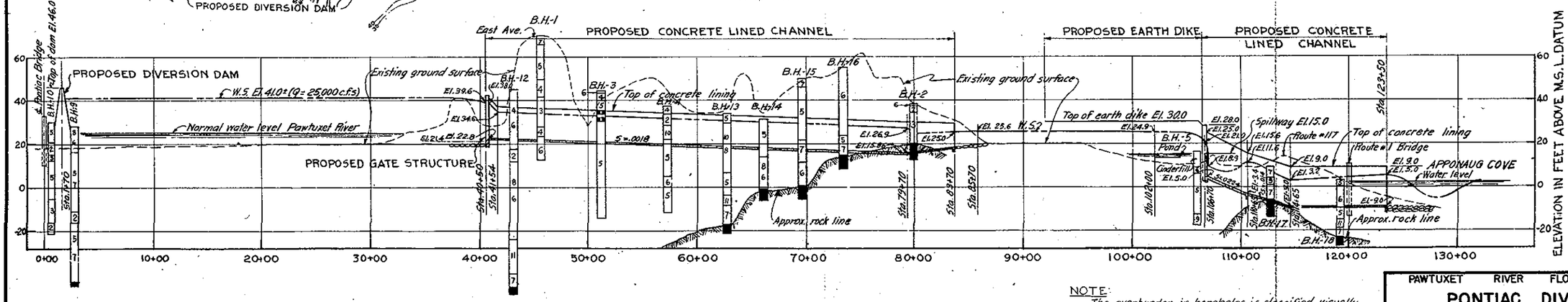
LOCATION MAP

SCALE OF MILES 0 5 10 15



PLAN

SCALE: 1"=400'



PROFILE DEVELOPED ALONG ℄ CHANNEL, AND CONTROL WORKS

SCALE: HOR. 1"=400'-0"
VERT. 1"=20'-0"

NOTE:
The overburden in boreholes is classified visually.

KEY	DATE	REVISION (indicated by △)	REV. BY	CK. BY	AP. BY

PAWTUXET RIVER FLOOD CONTROL

PONTIAC DIVERSION

GENERAL PLAN AND PROFILE

PAWTUXET RIVER RHODE ISLAND

IN SHEETS SCALE: 1"=400' SHEET NO.

400' 0 400' 800'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., JUNE 1944

SUBMITTED: C.D. Clark, ENGINEER, PROJECT ENGINEER

APPROVAL RECOMMENDED: J.B. Burns, HEAD ENGINEER, CHIEF, ENGINEERING DIV.

APPROVED: [illegible], COL. CORPS OF ENGINEERS, DISTRICT ENGINEER

PREPARED: [illegible], PROJECT URN NO. 4

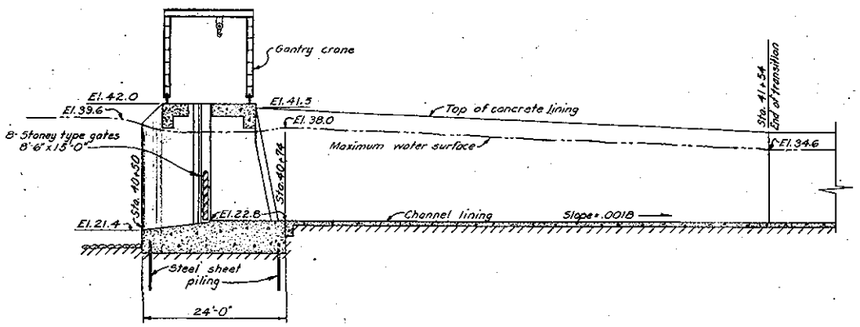
DRAWN: D.W.C.

TRACED:

CHECKED: [illegible]

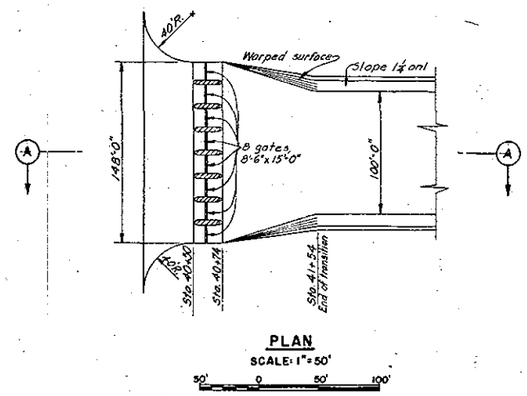
FILE NO. PT-4-1014

PLATE NO. 2



SECTION A-A

SCALE: 1" = 10'

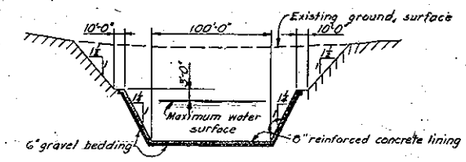


PLAN

SCALE: 1" = 50'

50' 0 50' 100'

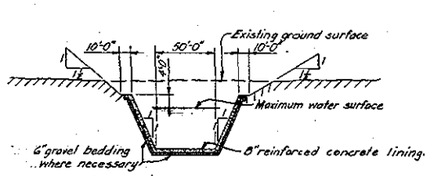
GATE STRUCTURE



TYPICAL CHANNEL SECTION

STA. 40+74 TO STA. 79+30

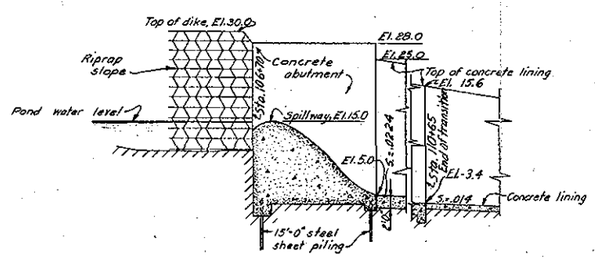
SCALE: HOR. 1" = 50'
VERT. 1" = 20'



TYPICAL CHANNEL SECTION

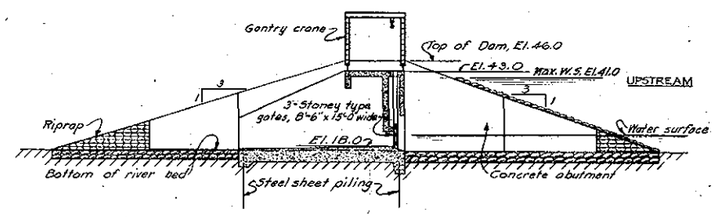
STA. 110+65 TO STA. 123+50

SCALE: HOR. 1" = 50'
VERT. 1" = 20'



SECTION THRU SPILLWAY

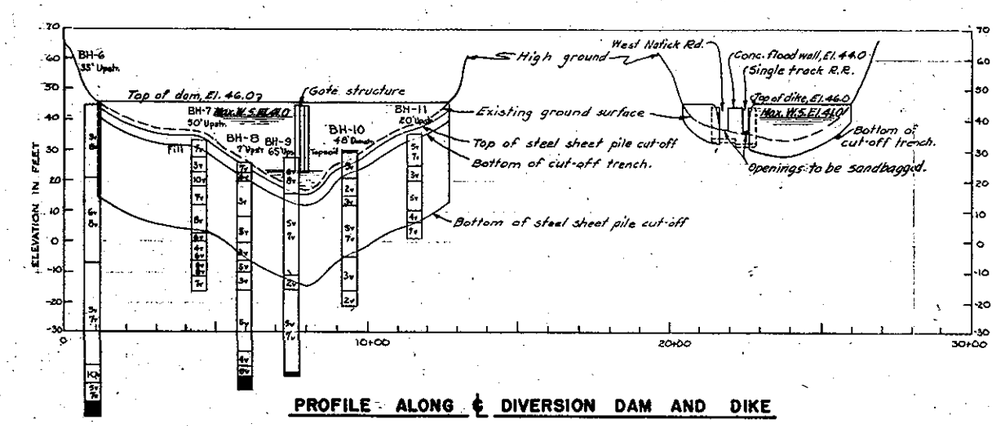
SCALE: 1" = 10'



SECTION THRU DIVERSION DAM

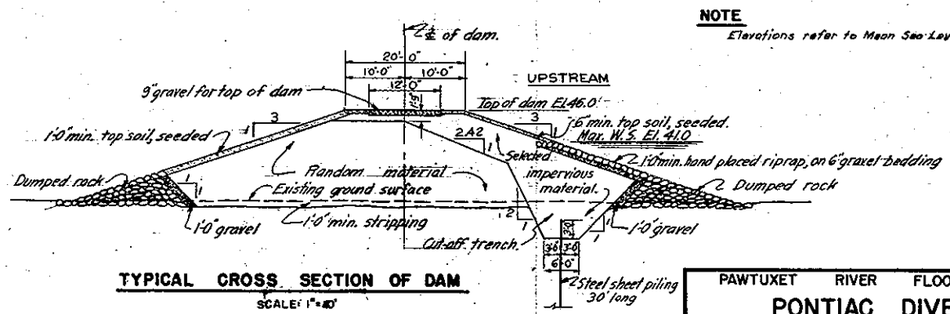
SCALE: 1" = 20'

20' 0 20' 40'



PROFILE ALONG ℄ DIVERSION DAM AND DIKE

SCALE: HOR. 1" = 200'
VERT. 1" = 100'



TYPICAL CROSS SECTION OF DAM

SCALE: 1" = 10'

NOTE

Elevations refer to Mean Sea Level Datum.

KEY	DATE	REVISION (Indicated by △)	REV. BY	CK. BY	AP. BY

PAWTUXET RIVER FLOOD CONTROL

PONTIAC DIVERSION

SECTIONS AND DETAILS

PAWTUXET RIVER RHODE ISLAND

IN SHEETS SCALE: 1" = 10' SHEET NO.

0 10' 20'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., JUNE 1944

SUBMITTED:	APPROVAL RECOMMENDED:	APPROVED:
E.B. Ward ENGINEER PROJECT ENGINEER	J.W. Bunnell HEAD ENGINEER CHIEF, ENGINEERING DIV.	Thomas COL. CORPS OF ENGINEERS DISTRICT ENGINEER

PREPARED: H. G. Lockwood PROJECT UNIT NO. 4

DRAWN: H. G. L.
TRACED:
CHECKED: [illegible]

FILE NO. PT-4-1015

PLATE NO. 3

PROVIDENCE DISTRICT SOIL CLASSIFICATION

CLASS	DESCRIPTION OF MATERIAL
1	Graded from Gravel to Coarse Sand. – Contains little medium sand.
2	Coarse to Medium Sand. – Contains little gravel and fine sand.
3	Graded from Gravel to Medium Sand. – Contains little fine sand.
4	Medium to Fine Sand. – Contains little coarse sand and coarse silt.
5	Graded from Gravel to Fine Sand. – Contains little coarse silt.
6	Fine Sand to Coarse Silt. – Contains little medium sand and medium silt.
7	Graded from Gravel to Coarse Silt. – Contains little medium silt.
8	Coarse to Medium Silt. – Contains little fine sand and fine silt.
9	Graded from Gravel to Medium Silt. – Contains little fine silt.
10	Medium to Fine Silt. – Contains little coarse silt and coarse clay. Possesses behavior characteristics of silt.
10C	Medium Silt to Coarse Clay. – Contains little coarse silt and medium clay. Possesses behavior characteristics of clay.
11	Graded from Gravel or Coarse Sand to Fine Silt. – Contains little coarse clay.
12	Fine Silt to Clay. – Contains little medium silt and fine clay (colloids). Possesses behavior characteristics of silt.
12 C	Clay. – Contains little silt. Possesses behavior characteristics of clay.
13	Graded from Coarse Sand to Clay. – Contains little fine clay (colloids). Possesses behavior characteristics of silt.
13C	Clay. – Graded from sand to fine clay (colloids). Possesses behavior characteristics of clay.

ENGINEERING DIVISION – SOILS LABORATORY PROVIDENCE, R. I.